Predicting Deer Population Mathematical Model

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"Brilliant. Got another bag?"

1 Introduction

The purpose of this mathematical model is to determine the deer population after a hunting season by knowing how many hunters there were at the beginning of that season. For instance, this model could be used to determine future harvest numbers each year in Colorado. This prediction could then serve to give the state an estimate for how many tags they hand out each year to hunters. Particularly for this model we only looked at Colorado's hunting statistics from 2004-2013. All matters of take (What instrument was used to kill the deer) were used for the statistics in this model. We are assuming that no poachers kill any deer in the years that we are looking at as well as there not being any road-kill in that same year. Natural causes of death are also neglected in this model.

2 Model Construction

As previously mentioned this model was constructed with data from Colorado's deer hunting statistics between the years 2004 and 2013. This data was then graphed and curves were fit to the data to find the best predicting model. Since this model relies solely on data collection it is an Empirical model. This Empirical model was used to fit polynomials from the first degree to the fourth degree. Certain criteria was then created to determine which model would be appropriate for use. Figure 1 shows the linear model for this mathematical model.

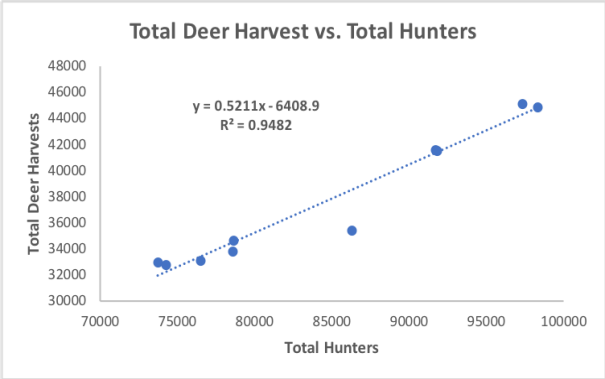

Figure 1: First Degree Plot

Figure 2 shows the second degree model is as follows.

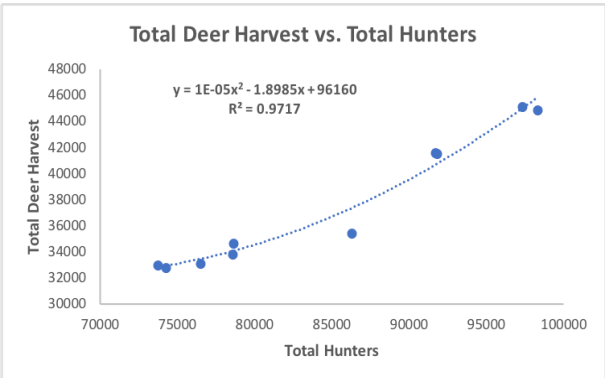

Figure 2: Second Degree Plot

Figure 3 shows the third degree polynomial.

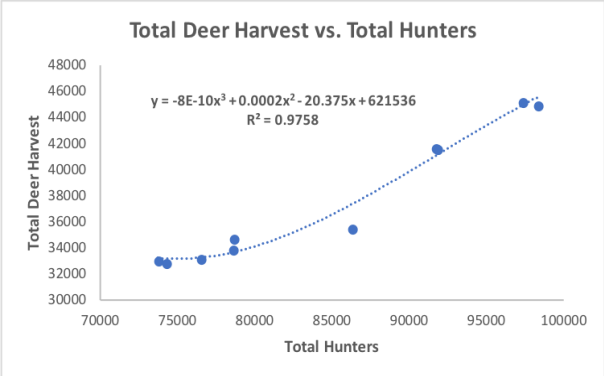

Figure 3: Third Degree Plot

The fourth and final polynomial can be seen in Figure 4.

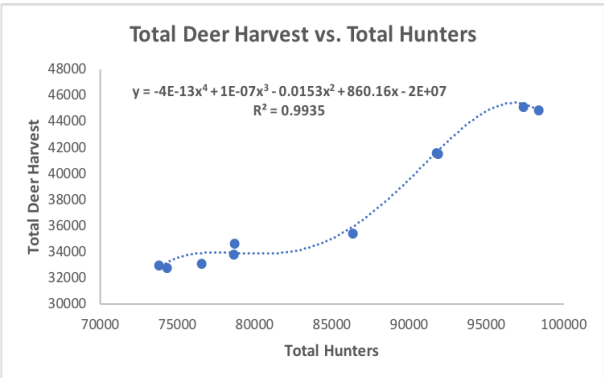

Figure 4: Fourth Degree Plot

It should be noted that these plots are graphing the total harvest in one year against the total number of hunters in that same year. Out of all of the polynomials, it can be observed that the fourth degree polynomial has the highest R^2 value. Although this usually indicates accuracy, the fourth degree polynomial should not be considered for this model because of the rapid fluctuations that it makes. From these four plots, the third degree polynomial is the most reliable for predicting harvest numbers each year. This is the furthest so far that I have gotten.

3 Future Work

For future work I plan on refining the models that I have now. I also plan on creating a model that takes into account the number of total rec days in a hunting season. This number changes as certain units have the number of days changed.